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Indian Standard

**SPECIFICATION FOR
BRAIDED NYLON ROPE FOR
MOUNTAINEERING PURPOSES**

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BUREAU OF INDIAN STANDARDS
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Indian Standard

SPECIFICATION FOR BRAIDED NYLON ROPE FOR MOUNTAINEERING PURPOSES

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Indian Standard

SPECIFICATION FOR BRAIDED NYLON ROPE FOR MOUNTAINEERING PURPOSES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 31 May 1972, after the draft finalized by the Cordages Sectional Committee had been approved by the Textile Division Council.

0.2 This standard has been prepared at the instance of High Altitude Warfare School, Ministry of Defence and is based on the requirements stipulated by them.

0.3 This standard contains clauses **3.2.4, 5.1.1, 7.1** and col 11 of Table 1 which call for agreement between the buyer and the seller.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS: 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes requirements for braided nylon rope of 10 mm diameter used generally as climbing ropes for mountaineering and high altitude operations.

2. TERMINOLOGY

2.0 For the purpose of this standard, the definitions given in IS: 3871-1966† shall apply.

3. MANUFACTURE

3.1 Yarn

3.1.1 The yarn used for the manufacture of rope shall be continuous filament (nylon 66 or nylon 6), high tenacity unadulterated new nylon

*Rules for rounding off numerical values (*revised*).

†Glossary of terms relating to fibre ropes and cordages.

yarn. The approximate count of the yarn in the core and sheath together with their construction are given in Table 1. The yarns shall have a minimum tenacity of 67.5 g per tex (or 7.5 g per denier).

3.1.2 The yarns for the core should be doubled and twisted together so that the ropes comply with the requirements of this standard.

3.1.3 The core and braiding should be well formed and free from knots, slubs or stains.

3.2 Rope

3.2.1 The braided rope should be tight. The rope should have uniform tension throughout its length. It should have uniform diameter with round cross-section and should be smooth to handle. It should be free from manufacturing flaws.

3.2.2 Each coil of braided nylon rope shall be continuous throughout its length and shall not contain any loose ends.

3.2.3 The extreme end of the rope shall be heat-sealed.

3.2.4 If required, the rope shall be dyed to the colour and shade as agreed to between the buyer and the seller.

4. REQUIREMENTS

4.1 Construction — The ropes shall comply with the requirements of Table 1.

4.2 Slackness of Sheath — The braided rope shall be free from slackness of sheath and core looping tendency.

4.2.1 The slackness of sheath and core looping tendency of the cord shall be tested by the method prescribed in **A-8**.

5. SEALED SAMPLE

5.1 If, in order to illustrate the pattern, workmanship, etc., of rope a sample has been agreed upon and sealed, the supply shall be in conformity with the sample in such respects.

5.1.1 The custody of the sealed sample shall be a matter of prior agreement between the buyer and the seller.

6. MARKING

6.1 Each coil of rope in a lot shall be marked with the following:

- a) Name (braided nylon rope for mountaineering or high altitude operation);
- b) Manufacturer's name, initials or trade-mark;
- c) Length of rope; and
- d) Year of manufacture.

NOTE — The above information may be given on a strong cloth label attached to the coil.

TABLE 1 REQUIREMENTS OF BRAIDED NYLON ROPE

(Clauses 3.1.1, 4.1 and 8.5)

DIA- METER IN mm	UNIVERSAL COUNT (OR DENIER) OF YARN (APPROX)		No. OF ENDS PER SPIN- DLE	No. OF ENDS IN THE SHEATH	No. OF ENDS IN THE CORE	LINEAR DENSITY OF ROPE, ktex (or g/m)	BREAKING LOAD ON 45-cm TEST LENGTH, Min, kg	ELONGATION IN PERCENT, Max		LENGTH OF COIL	ANGLE OF SAG	
	Core	Sheath						At 20 Percent Load	At Rupture			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
10	93 tex×7/3 (or 840 d/7/3)	93 tex×5 (or 840 d/5)	5	32	19	65	2 100	15	40		21±10°	
5	TOLE- RANCE	+2 -1	—	—	—	—	± 5 percent	—	—	—	As agreed	—
METH- OD OF TEST	A-4	—	—	—	—	—	A-3	A-5	A-5	A-5	A-6	A-7

NOTE — The constructional details of the rope, such as ends per spindle, ends in the sheath, ends in the core may be varied to suit the manufacturing conditions, provided the breaking load, linear density, elongation and angle of sag of the rope are successfully met.

6.2 BIS Certification Marking

The product may also be marked with Standard Mark.

6.2.1 The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

7. PACKING

7.1 Coils of rope shall be packed in accordance with the method prescribed in IS : 3256-1965* or as agreed to between the buyer and the seller.

8. SAMPLING

8.1 Lot — The quantity of coils of the same size and quality, delivered to one buyer against one despatch note shall constitute a lot.

8.2 The conformity of a lot to the requirements of this standard shall be determined on the basis of tests carried out on the sample selected from the lot.

8.3 Unless otherwise agreed to between the buyer and the seller, the number of coils to be selected at random from a lot shall be in accordance with Table 2.

TABLE 2 NUMBER OF COILS TO BE SELECTED FROM A LOT

No. OF COILS IN THE LOT	No. OF COILS TO BE SELECTED
(1)	(2)
Up to 100	3
101 to 300	4
301 to 500	5
501 to 800	6
801 and above	7

8.4 For evaluating (a) diameter, (b) linear density, (c) breaking load, (d) elongation, (e) length of coil, (f) flexibility, and (g) slackness of

*Code for inland packaging of ropes and cordages.

sheath, the number of coils selected in 8.3 shall constitute the test sample. The required test specimens shall be taken from each of the coils in the test sample and subjected to corresponding tests.

8.5 Criteria for Conformity — The lot shall be considered as conforming to the requirements of this standard, if:

- a) From the observed values of linear density and diameter, the average \bar{X} and range R are calculated, and the values of the expressions $(\bar{X} - 0.4R)$ and $(\bar{X} + 0.4R)$ lie within the limits specified in Table 1.
- b) From observed values of breaking load, the average \bar{X} and the range R are calculated and the value of the expression $(\bar{X} - 0.4R)$ is greater than or equal to the minimum value specified in Table 1.
- c) From the observed values for elongation and angle of sag average \bar{X} and range R are calculated and the values of the expression $(\bar{X} + 0.4R)$ is less than or equal to the applicable value specified in Table 1.
- d) Length of all the coils in the test sample is equal to or more than the length specified by the buyer in the purchase order.
- e) None of test specimens tested for slackness of sheath, according to A-8.2 to A-8.4, show more than 3 mm displacement of the mark; and none of the test specimens tested shows any sign of penetration of sheath by the core thread.

NOTE 1 — Average \bar{X} is the value obtained by dividing the sum of the observed values by the number of tests.

NOTE 2 — Range R is the difference between the maximum and the minimum in a set of observed values.

APPENDIX A

(Table 1)

METHODS OF TESTS

A-1. CONDITIONING OF SAMPLE

A-1.1 Prior to evaluation, the test sample shall be conditioned to moisture equilibrium in a standard atmosphere at 65 ± 2 percent relative humidity and $27 \pm 2^\circ\text{C}$ temperature for 48 hours.

A-2. ATMOSPHERIC CONDITIONS FOR TESTING

A-2.1 All tests shall be carried out in a standard atmosphere (*see A-1.1*) or within a period of fifteen minutes of the removal of the sample from the standard atmosphere (*see also IS : 196-1966**).

A-3. LINEAR DENSITY

A-3.1 Condition the test sample to moisture equilibrium (*see A-1*). Weigh in grams, each coil in the test sample.

A-3.2 From one end of each of the coils in the test sample, cut off a piece approximately 2 mm in length. Mark the coil and the piece so that one can be identified with the other.

A-3.3 Take one piece and apply to it a tension equal to one percent of the breaking load specified in Table 1.

NOTE 1 — The tension had best be applied in the breaking load testing machine; it can also be applied by fixing one end of the piece to a peg, running the piece over a pulley and hanging a weight equal to one percent of the breaking load at the other end.

NOTE 2 — According to **A-4**, the diameter of rope is also to be measured while it is under tension. The diameter may, therefore, be measured at this stage.

A-3.4 While the piece is under tension, place two gauge marks on it, exactly one metre apart.

A-3.5 Release the tension and cut the one-metre length from the piece which has been marked in **A-3.4**. Weigh the one-metre piece correct to the nearest gram.

A-3.6 The numerical value of weight in grams of the one-metre piece under tension is equal to the linear density of rope in kilotex.

A-3.7 Determine similarly the linear density of rope in each coil in the test sample.

A-4. DIAMETER

A-4.1 While the first two-metre piece is under tension (*see A-3.3*, Note 2), measure its diameter to the nearest millimetre by means of a rope gauge.

A-4.2 Determine similarly the diameter of rope in the remaining coils in the test sample.

A-5. BREAKING LOAD AND ELONGATION

A-5.1 From one end of each of the coil in the test sample cut off two test specimens of adequate lengths so that their initial test length clear of the grips is 45 cm. Condition these test specimens in standard atmosphere (*see A-1*).

*Atmospheric conditions for testing (*revised*).

A-5.2 Mount one specimen between the grips at both the straining and the stationary heads of a rope testing machine preferably power driven of appropriate capacity. The testing machine shall be capable of recording simultaneously the breaking load and the corresponding elongation of the rope.

A-5.3 Increase the load gradually and continuously keeping the speed of the straining head not less than 150 mm per minute and not greater than 300 mm per minute until the specimen breaks. Record the test values for breaking load (correct to the nearest 0.5 kg) and the elongation of the test specimen.

NOTE 1 — If the test values with an accuracy of 0.5 kg cannot be read off the dial of the tester, the values should be read off with the accuracy possible with the graduation of its dial, provided the buyer and the seller so agree.

NOTE 2 — The test shall take into account only the actual breaks which occur clear off the grips of the machine.

A-5.4 Test the remaining specimens similarly.

A-5.5 Calculate the following:

- i) the average of the test values for breaking load, and
- ii) the percentage of elongation on the initial test length of the rope between the grips.

A-6. LENGTH OF COIL

A-6.1 Using appropriate data obtained in compliance with **A-3.1** and **A-3.5** determine the length in metres, of a coil in the test sample by the following formula:

$$L = \frac{W}{a}$$

where

L = length of the coil in metres;

W = conditioned mass of the coil in grams (*see A-3.1*); and

a = conditioned mass of one metre length of rope between the gauge marks in grams (*see A-3.5*).

A-6.2 Determine similarly the length of each coil in the test sample.

A-7. FLEXIBILITY (BY MEASURING THE ANGLE OF SAG)

A-7.1 Take one coil from the test sample. Lay a portion of it in a relaxed condition on a smooth horizontal table. Place two spot marks on the surface of the rope 560 mm apart.

A-7.2 Bring two spot marks together, without twisting the rope so as to form a loop. Slide the loop over the table, projecting it beyond the edge of the table, until the two spot marks are just right on the edge of the table (see Fig. 1) and the remainder of the rope is held flat on the surface of the table.

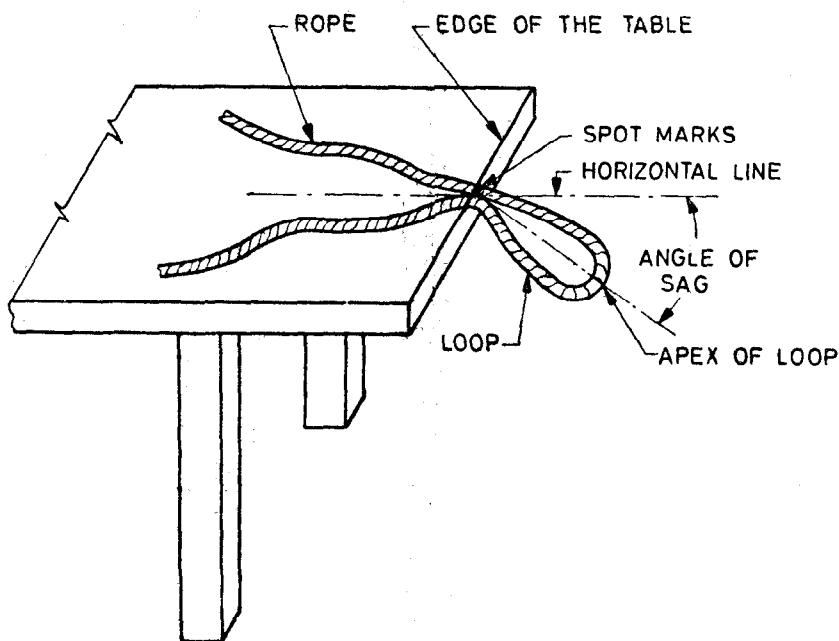


FIG. 1 METHOD OF MEASURING THE ANGLE OF SAG
IN THE FLEXIBILITY TEST FOR ROPE

A-7.3 Measure the angle of sag, that is, the angle between the horizontal line along the surface of the table and the line joining the edge of the table to the apex of the loop.

A-7.4 Withdraw the loop on the table and take it out. Rotate the rope about its axis through 90° without altering the twist. Form the loop again and repeat the procedure as given in **A-7.2** and **A-7.3**.

A-7.5 Measure the angle of sag of the loop with the rope rotated about its axis through 180° and 270° also.

A-7.6 Calculate the mean of the four values of the angle of sag measured as in **A-7.3**, **A-7.4** and **A-7.5** and record it as the angle of sag of the rope in coil.

A-7.7 Determine similarly the angle of sag of the remaining coils in the test sample.

A-8. SLACKNESS OF SHEATH

A-8.1 Test Specimen — For the purpose of this test, a piece of rope approximately 2 m in length, cut from each coil in the test sample shall constitute the test specimen.

A-8.2 Procedure — Take one test specimen and knot it firmly at both the ends. Make a mark on the test specimen at a distance of 2.5 cm from one end of the knot.

A-8.3 Starting from the other knot on the test specimen, pass it between the thumb and finger of one hand by using firm pressure so as to slide the sheath towards the marked end.

A-8.4 Observe the position of the mark and note the displacement of the mark, if any.

A-8.5 Now fold the test specimen, making it into loops of about 8 cm length, so that it may be conveniently held in one hand.

A-8.6 Hold the looped test specimen in one hand and impart rotatory rubbing motion to it by the other hand, applying medium pressure. The rubbings shall all be applied in the same direction. Continue the rubbing at the rate of one rub per second until a total of 60 rubs are imparted.

A-8.7 Observe the test specimen after the expiry of 60 rubs for any penetration of sheath by the core threads.

A-8.8 If there is no penetration of the sheath by the core threads, but bulges or nodules are observed on the test specimen, take two further test specimens and treat them in the same manner as described in **A-8.5**.

A-8.9 Observe the two test specimens for any sign of core thread having penetrated the sheath.

A-8.10 Repeat the test with the remaining test specimens.

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